The financial costs of irrigation services: assessment and meaning.

example from South Africa.

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Changing views and expectations over irrigation

- Massive investments over last 30 years
- Poor performance in government-managed smallholder irrigation systems

  Negative gross margins are commonly reported
  Aggregate average irrigation water value:

0.19 - 0.26 US$/m^3	*(vegetables; SA; Speelman et al. 2008)*
0.09	*(mixed crops; SA, Speelman et al. 2008)*
0.20	*(vegetables; Africa; Hussain et al. 2007)*
0.37	*(higher value crops; Africa; Hussain et al. 2007)*
1.15	*(lettuce; SA; Speelman et al., 2009)*

- Can be worth under heavy water consumption conditions (SE Asia):
  (Mullick et al., 2010, to be published)

Rice	*0.008-0.07 US$/m^3*
Tobacco	*0.18*
Wheat	*0.06*
Mixed vegetables	*0.04*

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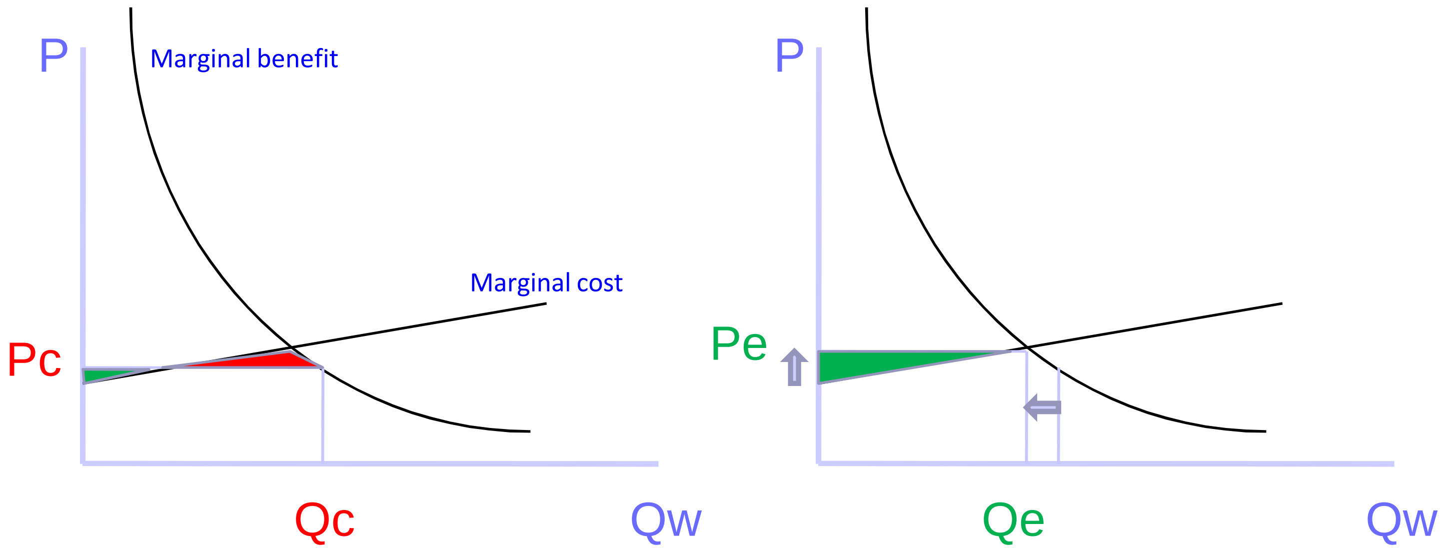
Changing views and expectations over irrigation

- IMT as a global move towards autonomy, improved performance, pricing / charging
- Pricing not for demand management, but for cost recovery (Producer surplus' sake)



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Changing views and expectations over irrigation

- South African smallholder, subsistence irrigation systems illustrate well those trends, the theory, and pending issues

  Marginal costs are low in canal / gravity based irrigation but
  how low exactly?
  What is "sustainable" cost recovery?
  Water productivity remains low but
  where is the marginal benefit function exactly?

  Lack of measurements, records on yields, water consumption and use

- Questions remain as to

  What are those costs? How can one assess them?
  How much should be recovered? Can smallholder farmers pay?

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Issues in evaluating costs in developing settings

- Lack of records on infrastructure and initial costs
- Multiple purpose and use of certain equipment and infrastructure; shift in use over time (irrigation vs. non irrigation uses)
- Partial refurbishment over time
- Part of command area becoming inactive over time
- Lack of standard basis for calculation under tropical, developing conditions (e.g. service life, maintenance requirements, discounting principles)

(Perret & Geyser, 2007)

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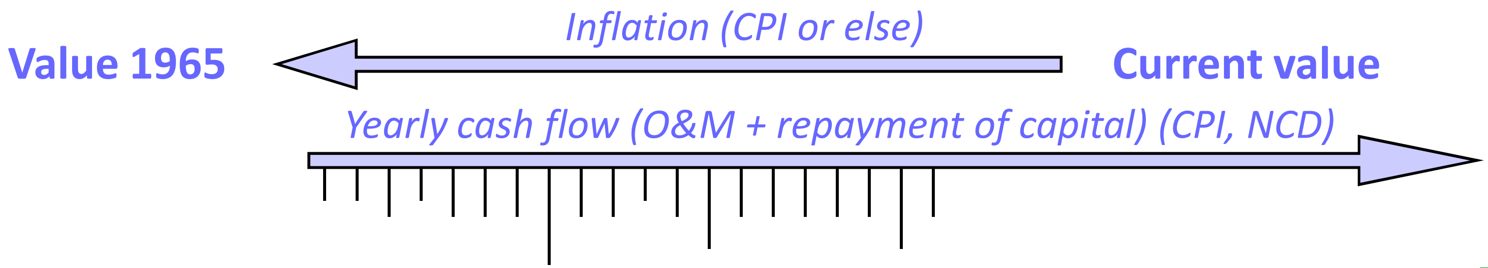
Evaluating full financial costs in a case study scheme: a discounted cash flow method

- **Inventory and evaluation**: establishing current value of all equipment and infrastructure
- Figures are **discounted back** to year of construction
  European Civil Eng. Index not available, other discount rates are used (e.g. CPI)
- Maintenance costs and virtual capital costs (settlement of loan) are then calculated yearly as **cash flows**, using NCD as discount rates, and with assumptions regarding maintenance rates, service life



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Evaluating full financial costs in a case study scheme: a discounted cash flow method (2)

- **Initial value:**

$$Value_t = Value_{t+1} - \left(Value_{t+1} \cdot i_t\right)$$

$$Value_{init} = Value_{current} \cdot \left(1 - i\right)^n$$

- **Annual M costs adjusted with inflation: i=CPI** $CF = CF \cdot \left(1 + i\right)^n$

- **NPV of yearly cash flow: d=NCD** $\mathrm{NPV} = \sum \frac{CF_t}{\left(1 + d\right)^n}$

- **PMT, yearly payment:**

$$\mathrm{NPV} = PMT \cdot \left[\frac{1 + \left(1 + d\right)^{-n}}{d}\right]$$

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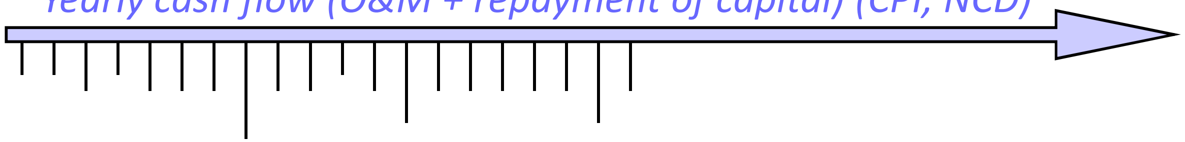
Evaluating full financial costs in a case study scheme: a discounted cash flow method (3)

- **Engineers are sometimes more comfortable with following terms:**

- **Present-value factor: (P/F, i%, n)** $= i \cdot (1+i)^n / (1+i)^n - 1$



- **Capital-recovery factor: (A/P, i%, n)** $= 1/(1+i)^n$

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Results: Calculating cost and required profit

- Net Present Value, total yearly Payment, and Required Net Profit per hectare to achieve targeted Return on Assets of 4%, per inflation scenario and under NCD as discount rate 6.5%

	NPV	Total PMT	PMT/ha	Target of 4% ROA Required Net Profit	RNP / ha
CPI-index NCF	R -5 264 716	R 384 652	R 550	R 210 589	R 300.84
Farming requisites index NCF	R -3 385 175	R 247 329	R 353	R 135 407	R 193.44
Civil engineering index NCF	R -2 101 826	R 153 564	R 219	R 84 073	R 120.10

- RoA is determined by National Water Resource Strategy (fixed at 4%); Required Net Profit to meet it are calculated from:

$$RoA = \frac{NetProfit}{TotalAssets} \qquad RNP = NPV \cdot RoA$$

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Result (2): Comparing required and actual profit

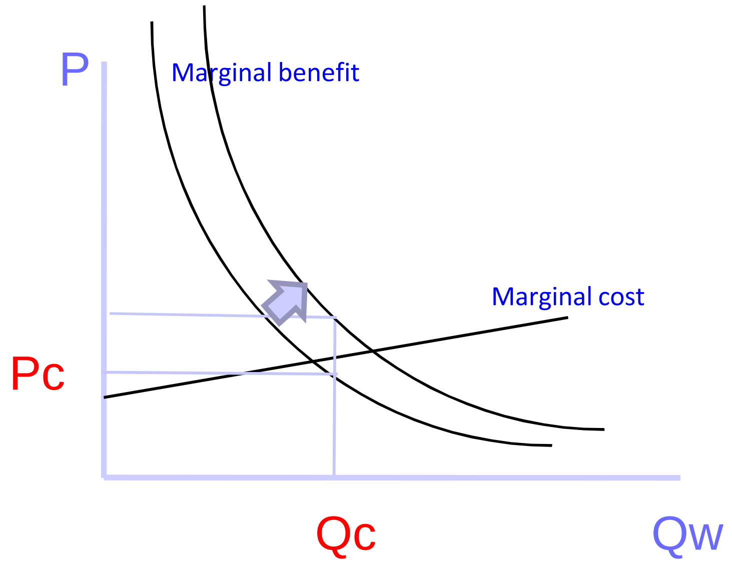
- Smallholder irrigation systems grow mostly maize
- Yields range between 1 to 7t per ha, with an average around 2t for subsistence farmers

Yielding scenario	Total income	Production costs	Net profit
2 t/ha	R 1,600	R 800	R 800
7 t/ha	R 5,600	R 2,200	R 3,400

- Required yearly payment per ha is between R 120 and 300 (towards RoA target)
- Required yearly payment per ha is between R 220 and 550 (towards cost recovery)
- Do the maths: subsistence farmers cannot realistically pay; others might.

Conclusion

- An interesting and feasible method in the absence of records:
  - Backwards-discounting approach to determine initial value of assets at construction
  - Net-present value approach to determine yearly cash flows
- Reflecting on farmers' performance: High costs vs. low performance
  - - Intensification (more inputs, higher value crops –easy to say…)



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Conclusion (2)

- Reflecting on farmers' performance: High costs vs. low performance
  - WTP for irrigation services seems to be higher than supposed
  - When existing, irrigation fees are duly paid if services match farmers expectations
  - However, full cost recovery looks unrealistic
- Example from SA (Thabina IS in 2003):
  - Existing fee: R 120 /ha
  - O&M costs only (mostly pumping): R 174 /ha
  - That is less than 70% covered, in a situation considered "favorable"
- In such situations, value or price per m^3 is irrelevant; rather think value or price per irrigable area-unit (poor measure for water demand management; quite efficient to increase irrigation land use)

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